VERIFICATION OF TRANSLATION

I, Huiying Xu, translator of 702, Keihanhondoori, Moriguchi-City, Osaka, Japan, hereby declare that I am conversant with the Japanese and English languages and am a competent translator thereof. I further declare that to the best of my knowledge and belief the following is a true and correct translation made by me of Japanese Publication of Examined Application No. S42-27221 filed on December 22, 1967.

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Publication of Examined Application

[Number] S42-27221

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[TITLE OF THE INVENTION]

HIGH PRESSURE SODIUM VAPOR DISCHARGE LAMP

[BRIEF DESCRIPTION OF THE DRAWINGS]

The figure is a longitudinal sectional view for a discharge lamp of the present invention.

[DETAILED DESCRIPTION OF THE INVENTION]

The present invention relates to improvement of a sodium vapor discharge lamp. With the improvement, the lamp is made small and, to have high efficiency and high color rendering properties.

The sodium vapor discharge lamp which has an arc tube with sodium sealed in is provided in a heat insulating big glass outer tube, has a sodium steam pressure of the arc tube under steady state illumination conditions being 10^{-3}mmHg. The lamp has the highest luminance efficiency among various conventional discharge lamps. However, the conventional sodium discharge lamp has various defects. That is the emitting light is almost yellow monochromatic ray and the color rendering properties is tremendously bad, therefore it does not fit for general illumination. The above-mentioned sodium steam pressure of 10^{-3}mmHg or so is considered as a prerequisite for realizing close to the maximum luminance efficiency of a lamp. However to realize the maximum efficiency, furthermore it must meet a condition that there is a long discharge path of no less than tens of centimeters,

therefore the lamp has become extremely large that it is very inconvenient to handle. Also to achieve uniformity of sodium stream distribution in the tube, it is necessary to add a special twist to the arc tube structure, and there will be a practical limit that the lamp should be lit up in almost a horizontal direction.

Meanwhile, for example, if a discharge is performed in a high pressure sodium steam of 200mHg or so, high luminance efficiency and an excellent color rendering properties of a color close to a white color can be realized in a short discharge path. However, to achieve the above-mentioned sodium steam pressure of 200mHg or so in an arc tube, there should be no low-temperature being under 750 ℃ part on the wall of the arc tube in which sodium is sealed.

The present invention is to provide a high pressure sodium discharge lamp of which a structure is small, simple and of high efficiency, of excellent color rendering properties, and is convenient for practical use. That is the discharge lamp of the present invention is characterized in that the discharge lamp comprises an arc tube body on which electrodes are provided respectively on both ends, to which sodium and inactive gas for generating electricity is sealed in, and which is made of sodium resistant translucent porcelain with a softening temperature no less than 1500 ℃; a heat insulating arc outer tube supporting the arc tube concentrically supporting the arc tube therein, by forming the heat insulating arc outer tube with a heat-resistant glass with a softening temperature of no less than 1000 ℃, and by selecting an internal diameter of the part of the outer tube surrounding the arc tube circumference to be in a range of no more than 10 times and no less than 3 times or so of the arc tube

external diameter, the arc tube wall load under steady state illumination conditions is no less than 20 W/cm^2 or preferably no more than $90W/cm^2$, and the minimum temperature part of the arc tube is in a range of no less than 750 ℃ and no more than 800 ℃.

The following describes about an embodiment of the discharge lamp of the present invention with reference to drawings. An arc tube including an arc tube 1, is made from a translucent alumina porcelain and is of a straight pipe shape, and the diameter is 10 mm or so and the length is 100 mm or so. The porcelain can withstand high heat of 2000 ℃ or so, can transmit visible radiation, and is sodium resistant. The both ends of the porcelain 1 are blocked and closed up by heat resistant metal plates 2 and 2′ of such as titanium, and electrodes 3 and 3′ are provided in an extended condition on an inner wall of the metal plate respectively, and sodium and for example neon-based inactive gas with a pressure of 20mmHg or so for generating electricity is sealed in the tube body. Furthermore, on the external wall of the metal plates 2 and 2′, short porcelain tubes 4 and 4′ having approximately the same diameter as the tube body 1 are respectively attached concentrically. The porcelain tube is for lessening the distortion on the metal plates 2 and 2′. The outer tube 5 concentrically supporting from the inside of the arc tube is made from heat-resistant glasses of which the softening temperature is no less than 1000 ℃ such as a quartz glass or high silica glasses (name of commodity is vycor glass) etc., and it is of nearly straight pipe shape. The part of the outer tube surrounding the arc tube circumference is selected to have an inner diameter with a range of approximately no more than 10 times and no less than 3 times of the arc tube external diameter,

and it is made vacuum or inactive gas such as argon is filled up in the outer tube.

Two pieces of lead-in conductive rods 6 and 7 are attached to one of the ends of the outer tube, and an electrode 3 lead-out wire of one side of arc tube 1 is connected with the conductive rod 6, and electrode 3 lead-out wire of another side of the arc tube is connected with the other conductive rod 7 via a lead-wire 8 which is bent in a square bracket shape and provided in parallel on the side surface of the arc tube. In this embodiment, lead wire 8 is made to be mechanically strong with heat-resistant metal such as tungsten etc., so that the lead wire 8 also has the effect of supporting the arc tube.

The structure of the above-mentioned discharge lamp of the present invention is designed to make the wall load of the arc tube 1 under steady state illumination conditions being no less than 20 W/cm^2, and preferable no more than 90 W/cm^2. That is, when discharge is generated with a voltage applied, the temperature of the center tube wall under steady state illumination conditions turns to be in a range of from approximately 1500 ℃ to nearly 2000 ℃, and the end of the tube of which the temperature is lowest turns to be an appropriate temperature with a range of 750 ℃ to 800 ℃, sodium steam with a pressure of from 200mmHg to 300mmHg filled up in the tube, and for example a light having a continuous spectrum of nearly white color with an efficiency of approximately 100ml/W is emitted. And the temperature of the wall part of the outer tube 5 facing the center portion of the arc tube which is lighted up turns to be for example 1000 ℃ or so.

The above-mentioned tube wall load of the arc tube 1 with no less than 20W/cm^2 or so gives out the minimum heat that is required to the arc tube, and together with the heat insulating effect, the above-mentioned suitable temperature of the arc tube lowest temperature part is realized. However when the diameter of the part surrounding the arc tube circumference of the outer tube 5 is nearly more than 10 times of the arc tube diameter, the heat insulating effect is reduced and it is difficult to realize the suitable temperature of the above-mentioned arc tube. Also when the diameter of the outer tube becomes no more than 3 times of the arc tube diameter, or the arc tube wall load becomes no less than 90W/cm2 or so, the temperature rising of the arc tube becomes excessive so that not only it is difficult to maintain the suitable temperature of the arc tube lowest temperature portion, but also there will be danger of transformations or damages caused by overheating of the center of the tube.

Also, the inside supporting of the arc tube to the out tube 5 may also be realized in a manner that fitting an appropriate support into the ends of the arc tube and engaging the support with the inner wall of the outer tube 5. However, it is of advantages if the lead wire 8 supports the arc tube so that the tube ends portion does not contact with other object, because the temperature difference between the tube end portion and the tube center portion can be reduced so that the heat load can be reduced.

A test model discharge lamp comprising an arc tube body 1 of which the external diameter is 10mm or so, the inner diameter is 8mm or so, and the length is 100mm or so; electrodes 3 and 3' of a height of 20mm or so which are provided in an extended condition on

both ends of the arc tube body 1, and the arc tube is supported in the outer tube 5 with an inner diameter of 70mm inside of which vacuum, when it is in a steady state illumination conditions with a tube voltage of 50V or so and a tube current of 10A, the lamp emits a nearly white color light with approximately 40,000 lumen, and the efficiency and the color of the illumination is constant independent of the direction of the illumination of the lamp such as horizontal or perpendicular direction.

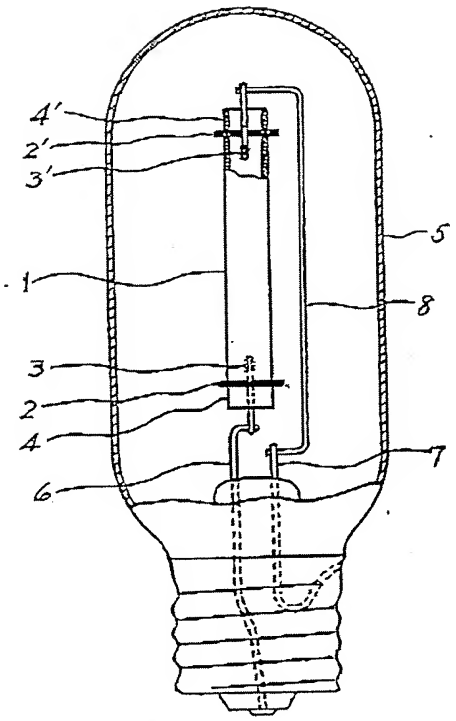
[CLAIM]

1. A high pressure sodium steam discharge lamp, comprising:

an arc tube including electrodes being respectively provided on both ends of a translucent porcelain tube which is sodium resistant and of which the softening temperature is no less than 1500 ℃, in which inactive gas and sodium are sealed;

an outer tube made from heat insulating glass with a softening temperature being no less than 1000 ℃ operable to support the arc tube concentrically, of which the inner diameter of the part surrounding the arc tube circumference is selected to be in a range of no less than 3 times and no more than 10 times of the arc tube external diameter, wherein

an arc tube wall load under steady state illumination conditions with a predetermined voltage is no less than 20 W/cm^2.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特　許　公　報

特許出願公告
昭42-27221
公告 昭42.12.22

(全8頁)

高圧ナトリウム蒸気放電灯

特　　願　昭 40—56628
出 願 日　昭 40. 9. 17
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図面の簡単な説明

図は本発明放電灯の縦断面図である。

発明の詳細な説明

本発明はナトリウム蒸気放電灯の改良に関し、小形、高効率で且つ優れた演色性があるようにしたものである。

ナトリウムを封入した発光管を保温用の径大ガラス外管内に支持したナトリウム蒸気放電灯は、一般に、安定点灯中の発光管内ナトリウム蒸気圧が約 10^{-3}mmHg であるように設計してあつて、在来の各種放電灯のうちで最高の発光効率を有するとされている。しかしこの従来のナトリウム蒸気放電灯には種々の欠点がある。即ち、発光がほぼ黄色の単光色であつて演色性が甚だ悪く、一般の照明には適さない。上記約 10^{-3}mmHg のナトリウム蒸気圧は灯のほぼ最高の発光効率を得るための必要条件とされているが、上記最高の効率を達成するためには、更に、例えば数十cm以上というような長い放電路があるという条件が必要であつて、このために灯が極めて長大であつて取扱いに甚だ不都合である。また管内ナトリウム蒸気分布の一様性を得るために、発光管の構造に特殊の工夫を施す必要があり、且つ灯をほぼ水平向きに点灯しなければならないという実用上の制限がある等である。

ところで、例えば約200mmHgの高圧なナトリウム蒸気中で放電を行わせると、短かい放電路で高い発光効率と白色に近い優れた演色性とが得られる。しかしながら、発光管内に上記約200mmHgのナトリウム蒸気圧を得るためには、ナトリウムを封入した発光管の壁に約750℃以下の低温部分があつてはいけない。

本発明は構造が小形且つ簡単で高い効率と優れた演色性とを有し実用に便利な高圧ナトリウム蒸気放電灯を提供するものである。即ち本発明放電灯は、両端に夫々電極を備えナトリウムと起電用の不活性ガスとを封入した発光管管体を軟化温度が約1500℃以上の耐ナトリウム性の透光性磁器で作り、この発光管を内部に同軸的に支持した保温用外管を軟化温度が約1000℃以上の耐熱ガラスで作つて且つ発光管周を取巻く部分の上記外管の内径を発光管外径の約10倍以下乃至約3倍以上の範囲内に選定することによつて、安定点灯中の発光管管壁負荷が約20W/cm²以上乃至なるべくは90W/cm²程度以下である範囲内において、発光管の最低温部の温度が約750℃以上乃至約800℃以下の範囲内であるようにしたことを特徴とする。

以下本発明放電灯の実施例を図面について説明する。発光管1を構成する管体は透光性アルミナ磁器より成る径が例えば10mm前後、長さが例えば100mm前後の直管状のものであつて、該磁器は2000℃程度迄の高熱に耐え、可視線をよく透過し、且つナトリウムに侵されない。該磁管1の両端はチタンのような耐熱金属板2，2′で夫々封塞され、該金属板内壁には夫々電極3，3′が突設され、管体1内にはナトリウムと例えばネオンを主体とした圧力例えば20mmHg程度の起動用不活性ガスとが封入されている。なお上記金属板2，2′の外壁には、管体1と同質でほぼ同径の短尺の磁器筒4，4′が夫々同軸的に接着されている。該磁器筒は金属板2，2′にかかる歪みを緩和するためのものである。上記発光管を内部に同軸的に支持した外管5は、例えば石英ガラスまたは高珪酸ガラス(商品名パイコールガラス)等のような軟化温度が約1000℃以上の耐熱ガラスより成る例えばほぼ直管状のものである。該外管の発光管1の周りを取巻く部分は発光管外径の約10倍以下乃至約3倍以上の範囲内に選定した内径に形成され、該外管内は真空とするかまたはアルゴンのような不活性ガスが充塡されている。

上記外管の例えば一方の端部には2本の導入導電棒6及び7が封着され、一方の導電棒6には発光管1の一方の電極3引出線が接続され、他方の導電棒7には、例えばコ字形に折り曲げて発光管側面に並設したリード線8を介して発光管他方の電極3′引出線が接続されている。本実施例では、リード線8をタングステン等の耐熱金属で機械的に強い太いものに形成してこれに発光管支持の用を兼ねさせてある。

上記本発明放電灯は所定の管電圧で安定放電中の発光管1管壁負荷が約20W/cm²以上であつて且つなるべくは90W/cm²程度以下であるように構成されたものである。即ち、電圧印加に伴つて内部に放電が発生する発光管1の安定放電中の中央部管壁は約1500℃乃至2000℃近い温度になり、最も温度の低い管端部は約750℃～800℃の適温になり、管内は圧力約200mmHg～800mmHgのナトリウム蒸気で満され、例えば100 ml/Wに近い効率でほぼ白色の連続スペクトルを有する光が放射される。なお点灯中の発光管1の中央部分に対向する外管5の壁部分は例えば1000℃前後の温度になる。

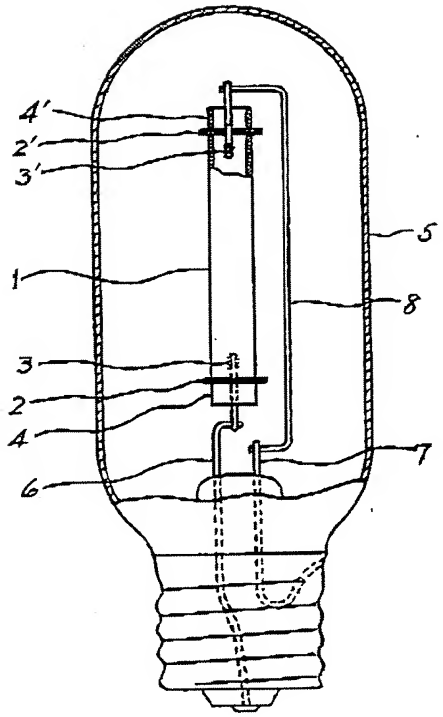
上記した発光管1の管壁負荷約20W/cm²以上は発光管に必要最低限の熱を与え、外管5の保温効果と相俟つて発光管最低温部の上記適温を達成する。但し外管5の発光管周を取巻く部分の径が発光管径の約10倍を超えると、保温効果が減つて上記発光管適温の達成が困難になる。また上記外管部分の径が発光管径の約3倍以下になり、或いは発光管管壁負荷が90W/cm²程度以上になると、発光管の温度上昇が過大になつて発光管最低温部の上記適温保持が困難になるばかりでなく、管の中央部が過熱して変形或いは破損する危険が生ずる。

なお、発光管1の外管5内支持は、発光管端部に適当な支持体を嵌着して該支持体を外管5内壁に係合させるというような方法で行つてもよい。しかし、上記実施例のように、リード線8に発光管を支持させて管端部に他の物体を接触させない方が、管端部と管中央部との温度差を少なくして管の熱負担を軽くするうえに有利である。

発光管管体1を外径約10mm、内径約8mm、長さ約100mmの大きさに形成し、その両端に高さ約20mmの電極3，3′を夫々突設し、上記発光管を内径約70mmの内部真空の外管5内に支持した本発明にかかる試作放電灯は、管電圧約50V、管電流約10Aで安定点灯して約4万ルーメンのほぼ白色光を放射し、その効率並びに発光の色は水平または鉛直等の灯の点灯向きの如何に関係なく一定であつた。

特許請求の範囲

1　軟化温度が1500℃以上の耐ナトリウム性の透光性磁器管の両端に夫々電極を備え内部に不活性ガスとナトリウムとを封入した発光管と、軟化温度が1000℃以上の耐熱ガラスより成つて上記発光管を内部に同軸的に支持し、該発光管周を取巻く部分の内径が発光管外径の3倍以上10倍以下の範囲内に選定された外管とを具備して成り、所定管電圧で安定放電中の発光管管壁負荷が20W/cm²以上であることを特徴とする高圧ナトリウム蒸気放電灯。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